

Challenges and Solutions: Master's Student Training for Post-Industrial Economy

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The paper discusses the problems and their solutions, associated with the quality enhancement of Master's program training in engineering with a view to a post-industrial economy.

Key words: *master's students, post-industrial economy, active training techniques.*



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The basic principles of education program development, training technologies and education system itself depend on the social and economic structure of the society.

We must now subject the main differences of industrial and post-industrial education and economy to a somewhat closer scrutiny (Table 1) [1].

Higher education in the industrial society is widely regarded being a public benefit and it is provided on the bases of technocratic approaches and autocratic class and lesson system originally designed by Jan Amos Komensk in VII century. The system is aimed to provide mass education and meet the requirements of mass production characterized by low-changing nomenclature.

In due time, this reform was considered to be a breakthrough in the system of education.

Unlike industrial society that is motivated by mass production of goods

and services, post-industrial economy is focused on an absolutely different type manufacture:

- production of goods and services in accordance with customers' needs,
- development of market driven industry,
- anthropocentric approach,
- science-based production.

In post-industrial society, an economic transition has occurred from a manufacturing based economy (concentrated production areas) to the dispersed production networks, i.e. corporations and transnational companies. Thus, economic globalization can be observed.

High «quality of life», personal fulfillment and knowledge-driven industries are the main characteristics of a new social and economic structure of the society.

As for education, it is no longer viewed being a public benefit, but an educational service obtained through

Table 1.

Social and Economic Characteristics	Industrial Society	Post-Industrial Society
Predominant manufacturing model	<ul style="list-style-type: none"> ■ mass use of machinery for solving social and economic problems; ■ mass production of standardized goods characterized by low-changing nomenclature 	<ul style="list-style-type: none"> ■ production of goods and services to meet consumer's (client) needs
Manufacturing process management	<ul style="list-style-type: none"> ■ succession of technological processes in terms of concentrated production sites (plant, factory and etc.); ■ standardization; ■ centralization; ■ gigantomania 	<ul style="list-style-type: none"> ■ transnational corporations; ■ «market-driven industry»; ■ anthropogenic approach; ■ science-based industry
Primary factor of production	financial capital	intellectual capital (human, structural, managerial, innovative, process-driven)
Social and economic structure of the society	<ul style="list-style-type: none"> ■ economics of scale; ■ technocratic approach; ■ mass production and distribution; ■ mass culture and education 	<ul style="list-style-type: none"> ■ economy globalization; ■ high «quality of life»; ■ personal fulfillment
Education system	<ul style="list-style-type: none"> ■ education as a public benefit; ■ education is out of manufacturing; ■ class and lesson system; ■ authority 	customer-oriented system of educational services based on: <ul style="list-style-type: none"> ■ self-administration, ■ personal orientation, ■ continuity, ■ efficiency, ■ quality, ■ result assurance, ■ naturalness

self-planning, self-education, and self-orientation and characterized by sustainability, efficiency, naturalness and result assurance within a person life pattern.

Several failed attempts have been made since 1960 to modernize traditional class and lesson education system regarding new requirements. Today the class and lesson system is critically reviewed.

To give an example, D. Sanghera, professor of University of Michigan (the USA) said: «We are approaching the

completion of a great experiment in mass education».

The class and lesson system of mass education designed by Jan Amos Komenský turned out to be a failure as it educated several generations of unskilled personnel showing absurdly high level of ignorance. This system kills the desire to continue studies both in adults and youths.

The class and lesson system is aimed at training of numerically insignificant elite that can make a success due to its capabilities and talents. Contrary to what one might expect from education, it breeds poorly educated and

absolutely indifferent majority of people deprived of any possibilities». (<http://www.si.umich.edu>), [2].

Today, the study of professional education system which would meet the requirements of post-industrial economy and society is proceeding vigorously.

Let us consider the basic requirements for educational Technology Master's Degree program.

First of all, it should be realized that in terms of the transition to the innovative economy Technology Master's Degree program is viewed as one of the strategic interests of the Russian Federation. Masters of Technology, being the representatives of innovative culture, must accelerate production industry development and contribute towards the acquisition of new technologies.

It is essential to help Master's students to conceive the fact that they belong to the professional elite meant to play a key role in post-industrial economy reconstruction.

Technology Master's Degree program must be focused on the development of the following competitive skills and advantages:

- acquisition of knowledge in engineering problem solution, innovation studies, mechanical and civil design;
- ability to work on projects in interdisciplinary network, interact with the experts of various subject fields through telecommunication media and technology;
- acquaintance with the methodology of automated cooperative design of complex systems at all stages of life cycle (CALS-technologies);
- innovative way of thinking and creativity;
- integrated and interdisciplinary knowledge, application of multicriteria approach to solving complex problems;
- experience in research work, including engineering, economic and ecological decisions, knowledge of technology transfer methods;
- sustainable motivation for continuing education;

- ability to apply self-administration techniques for professional, personal and talent development;
- English language fluency for professional interaction.

The above-mentioned competitive advantages would enable Master's students to work and take the decisions more effectively in comparison with enterprise's specialists.

Master's students training must be provided through self-directed and self-planned learning in accordance with competence-based programs characterized by interdisciplinary methodology, flexibility (module-based), learner-oriented approach, and liberal structure.

The necessity to combine deep fundamental knowledge with engineering creative work and entrepreneurial skills poses a major challenge concerning Master's students training for post-industrial economy.

To overcome this difficulty it is necessary to change the Master's program itself.

Today, it is obvious that traditional understanding of professional education as an acquisition of a definite set of knowledge, based on teaching of fixed subjects, is not sufficient to provide an effective training of Master's specialists. Moreover, it significantly retards the formation of new ways of thinking.

Not only subjects should become the basis of education, but also the ways of thinking and functioning, i.e. procedures of reflective nature. Knowledge and methods of learning and functioning should be united into organic integrity.

All this poses a task of including the following issues into the requirements to content and level of engineering training:

- fundamentalization of engineering knowledge and activity;
- assurance of innovative thinking development;
- specialist complex training for further innovative activity (abilitation).

An essential point in Technology Master's student training must be funda-

mentalization of engineering knowledge and activity (Fig. 1).

The development of innovative thinking must be considered as one of the main objectives in Master's training for post-industrial economy (Fig. 2).

Innovative way of thinking comprises creative, strategic, systematic and transformational mental activities, as well as peculiarities of interdisciplinary knowledge.

Complex training of specialists for further innovative activity must be viewed as an integral part of Master's program (Fig. 3).

The application of effective technologies and international information resources for knowledge acquisition, development of professional, educational and personal qualities must be regarded as a crucial point in Master's student training:

- benchmarking, case-technology, personal and professional development courses, business-training activities;
- business games and team building activities;
- problem and project based study;
- workshops;
- project sessions;
- interdisciplinary projects;
- project fulfillment according to customer's needs.

It is very important for Master's students to be involved in real task completion and project work fulfillment in order to stir their creative activity and develop target-oriented education.

All this would contribute to the transition from the entirely educational process to the so-called science-based education in terms of Master's students training.

Science-based education can be represented as a system of workshops organized by distinguished scientists and leading engineers. The updated community of Bachelor's and Master's students, post-graduates and candidates for a Doctor's degree forms a creative team, a kind of scientific school capable of ensuring consistency of educational and profes-

sional methodology, developing the concepts of the world and man, forming scientific and engineering ideals, values and targets, and passing the research traditions down to the next generations of engineers.

Contemporary educational technologies within the frame of Master's students training must also imply participation of students in various academic mobility programs.

Today all-sufficiency of the university in any country, which is aimed at professional training of engineers competitive on the world market of intellectual labor, has been exposed to fair criticism. The necessity of academic mobility programs that enable students to study both in Russian and foreign universities, as well as to participate in a large enterprise level is generally recognized to be very important.

Based on the above mentioned reasoning and facts, the following conclusion can be made:

- the main objective of Master's Degree program is to ensure competence-based education of specialists who will be able to take decisions under competitive conditions, to settle down quickly in a new job environment and to perform their work better than those who have been already working for a long time. Master's students must be ready to become the representatives of innovative culture who will significantly accelerate industry development and new technology acquisition;
- it is essential to help Master's students to conceive the fact that they constitute professional elite characterized not only by deep knowledge obtained through competency-based training, but also by willingness to work in the terms of post-industrial economy;
- Master's students training must be provided through self-directed and self-planned learning in accordance with competence-based programs characterized by interdisciplinary methodology, flexibility (module),

Fig.1.

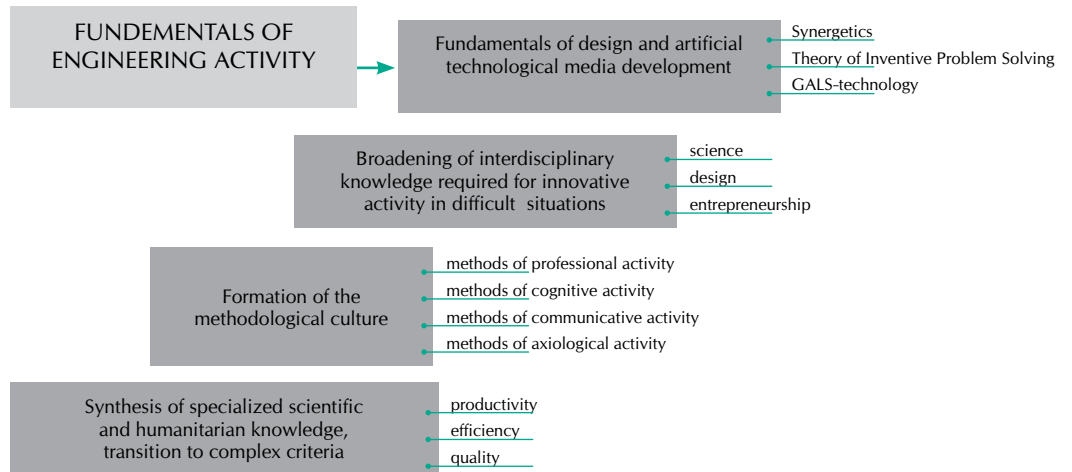


Fig. 2.

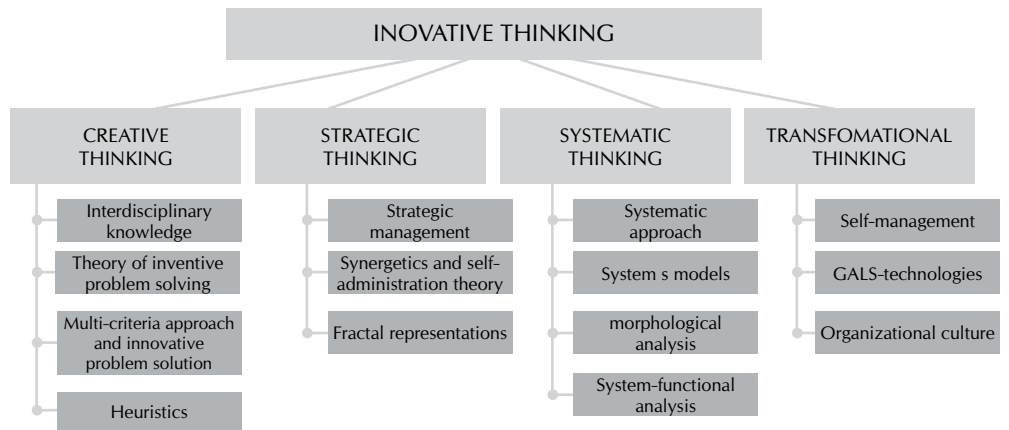
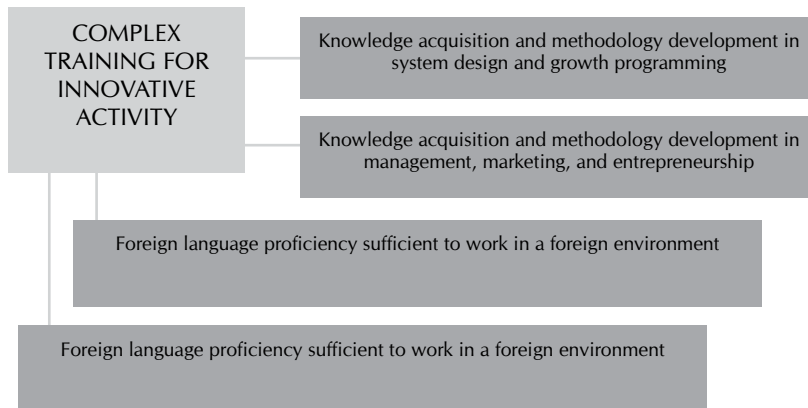


Fig. 3.



learner-oriented approach, and liberal structure;

- Master's degree programs must be based on active learning techniques, international information resources, intensive study with distinguished faculty, active participation of students in research and project work, carried out in technological incubators and strategic partner's sites;
- To train specialists competitive on the world market of intellectual

labor it is crucial to expand student academic mobility by implementing Double Degree programs and active participating of industrial enterprises.

To conclude, I would like to emphasize that in order to succeed in solving problems of Master's student training it is necessary to attract Bachelors from different Russian universities based on competitive selection.

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